

SECTION 03200

CONCRETE REINFORCEMENT

This section includes reinforcing steel and required supports, for cast-in-place concrete. This section is also referenced in other SPECTEXT sections for reinforcement materials and installation. This section references ACI 301 and ACI 318. ICC codes require use of ACI 318. Edit references to suit Project conditions.

This section includes provision for work performed using unit price payment method, when applicable.

Manufacturers listed in this section were identified as representative and not as an endorsement for meeting this specification. For additional product information, visit 4Specs at www.4specs.com, ARCAT at www.arcata.com, Reed Construction Data FirstSource at www.firstsourceonl.com, SpecSource at www.specsource.com, and Sweets at www.sweets.construction.com.

This section includes performance, proprietary, and descriptive type specifications. Edit to avoid conflicting requirements.

Contact the CSRF Support Center at supportcenter@csrf.org to submit comments or suggestions for improvements to this specification. Visit the SPECTEXT web site at www.spectext.com for current product announcements.

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Reinforcing bars.
 - 2. Welded wire fabric.
 - 3. Reinforcement accessories.

- B. Related Sections:
 - 1. Section 02458 - Concrete-Filled Steel Piles.
 - 2. Section 02465 - Bored Piles.
 - 3. Section 02470 - Drilled Concrete Piers and Shafts: Reinforcement for [pile] [drilled pier] foundations.
 - 4. Section 03100 - Concrete Forms and Accessories.
 - 5. Section 03300 - Cast-in-Place Concrete.
 - 6. Section 03350 - Concrete Finishing: Reinforcement for concrete floor toppings.
 - 7. Section 03371 - Shotcrete: Reinforcement for shotcrete.
 - 8. Section 03380 - Post-Tensioned Concrete.
 - 9. Section 03410 - Plant-Precast Structural Concrete: Reinforcement for precast structural concrete.
 - 10. Section 03450 - Plant-Precast Architectural Concrete: Reinforcement for precast concrete panels.

11. Section 03470 - Tilt-Up Precast Concrete: Reinforcement for tilt-up precast concrete.
12. Section [_____] - [_____]: Reinforcement for masonry.
13. Section 16060 - Grounding and Bonding: Grounding concrete reinforcement.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

Use this article ONLY when work of this section is performed under unit price payment method. Delete this article when payment is by Stipulated Sum/Price.

A. Bar Reinforcement:

1. Basis of Measurement: By the [ton] [_____] ([900 kg] [_____]).
2. Basis of Payment: Includes reinforcement, placement, and accessories.

Where welded wire fabric is priced by square foot (square meter) units, consider using multiple prices for various wire sizes and spacing required for Project.

B. Welded Wire Fabric Reinforcement:

1. Basis of Measurement: By the square [foot] [_____] (square [m] [_____]).
2. Basis of Payment: Includes welded wire reinforcement, placement, and accessories.

***** [OR] *****

C. Welded Wire Fabric Reinforcement:

1. Basis of Measurement: By the [1000] [_____] pounds ([450] [_____] kg).
2. Basis of Payment: Includes welded wire reinforcement, placement, and accessories.

1.3 REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:

1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
4. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
5. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
6. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
7. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
8. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
9. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
10. ASTM A775/A775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
11. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
12. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
13. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
14. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.

C. American Welding Society:

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:

1. CRSI - Manual of Standard Practice.
2. CRSI - Placing Reinforcing Bars.

1.4 SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel [and welded wire fabric,] bending and cutting schedules, [and] supporting and spacing devices [and] [_____].
- C. Certificates: Submit AWS qualification certificate for welders employed on the Work.

- D. Manufacturer's Certificate: Certify [Products] [_____] meet or exceed [specified requirements] [_____].

Add appropriate paragraphs when testing of reinforcing steel is required, to verify quality and properties of reinforcing steel conform to requirements specified. Normally, Mill Test Certificates are acceptable in lieu of testing.

Material analysis of reinforcing steel is required, except for ASTM A706 materials, to determine procedure for welding reinforcing.

1. Submit certified copies of mill test report of reinforcement materials analysis.

1.5 QUALITY ASSURANCE

When two or more of the following reference standards are utilized, be cautious of contradictory requirements between selected references.

- A. Perform Work in accordance with [CRSI - Manual of Standard Practice] [ACI 301] [ACI 318].
- B. Prepare shop drawings in accordance with ACI SP-66.
- C. Perform Work in accordance with [[State] [Municipality] of [_____] [Highways] [Public Work's] standard.]

Include the following paragraph only when cost of acquiring specified standards is justified.

- D. Maintain [one copy] [[_____] copies] of [each] document on site.

1.6 QUALIFICATIONS

- A. Welders: AWS qualified within previous 12 months.

1.7 COORDINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

Verify reinforcing steel type and requirements prior to editing the following paragraphs. Reinforcing steel conforming to ASTM A615/A615M with yield strength of 60 ksi (420 MPa) is most commonly used.

ASTM A706/A706M reinforcing steel is intended for applications where controlled tensile properties, or chemical composition restrictions to enhance weldability, or both, are required.

- A. [Deformed] [and] [Plain] Reinforcement: ASTM A615/A615M; [40] [60] [75] ksi ([280] [420] [520] MPa) yield strength, steel bars, [unfinished] [galvanized finish] [epoxy coated finish].

***** [OR] *****

- B. [Deformed] [and] [Plain] Reinforcement: ASTM A706/A706M; 60 ksi (420 MPa) yield strength, steel bars, [unfinished] [galvanized finish] [epoxy coated finish].

***** [OR] *****

For reinforcement in the two following paragraphs, bars are available in sizes 3 to 8 (10 to 25), only.

- C. Deformed Reinforcement: ASTM A996/A996M; [50] [60] ksi ([350] [420] MPa) yield strength, Type R steel bars, [unfinished] [galvanized finish] [epoxy coated finish].

***** [OR] *****

- D. Deformed Reinforcement: ASTM A996/A996M; [40] [60] ksi ([300] [420] MPa) yield strength, Type A steel bars, [unfinished] [galvanized finish] [epoxy coated finish].

- E. Deformed Bar Mats: ASTM A184/A184M; fabricated from [ASTM A615/A615M] [or] [ASTM A706/A706M]; [40] [60] ksi ([280] [420] MPa) yield strength, steel bars, [unfinished] [galvanized finish] [epoxy coated finish].

***** [OR] *****

- F. Plain Bar Mats: ASTM A704/A704M; fabricated from [ASTM A615/A615M] [or] [ASTM A706/A706M]; [40] [60] ksi ([280] [420] MPa) yield strength, steel bars, [unfinished] [galvanized finish] [epoxy coated finish].

- G. Deformed Wire: ASTM A496; [unfinished] [epoxy coated finish].

***** [OR] *****

- H. Plain Wire: ASTM A82; [unfinished] [galvanized finish] [epoxy coated finish].

- I. Welded Deformed Wire Fabric: ASTM A497; in [flat sheets] [coiled rolls]; [unfinished] [epoxy coated finish].

***** [OR] *****

- J. Welded Plain Wire Fabric: ASTM A185; in [flat sheets] [coiled rolls]; [unfinished] [galvanized finish] [epoxy coated finish].

2.2 ACCESSORY MATERIALS

- A. Tie Wire: [Minimum [16] [_____] gage annealed type] [, epoxy coated.] [Patented system, [_____] manufactured by [_____].]
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions [including load bearing pad on bottom to prevent vapor retarder puncture].
- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: [Plastic-coated steel] [Plastic tipped steel] [Stainless steel] type; size and shape to meet Project conditions.
- D. Reinforcing Splicing Devices: Exothermic welding type; full [tension] [and] [compression]; sized to fit joined reinforcing.
 - 1. Manufacturers:
 - a. [_____] Model [_____].
 - b. [_____] Model [_____].
 - c. [_____] Model [_____].
 - d. Substitutions: [Section 01600 - Product Requirements] [Not Permitted].

***** [OR] *****

- E. Reinforcing Splicing Devices: Mechanical [set screw] [swaged] [threaded] type; full [tension] [and] [compression]; sized to fit joined reinforcing.
 - 1. Manufacturers:
 - a. [_____] Model [_____].
 - b. [_____] Model [_____].
 - c. [_____] Model [_____].
 - d. Substitutions: [Section 01600 - Product Requirements] [Not Permitted].
- F. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.3 FABRICATION

- A. Fabricate concrete reinforcement in accordance with [CRSI Manual of Practice] [ACI 318] [[applicable] [_____] code].
- B. Form standard hooks for [180 degree bends,] [90 degree bend,] [stirrup and tie hooks,] [and] [seismic hooks] as indicated on Drawings.
- C. Form reinforcement bends with minimum diameters in accordance with [ACI 318] [[applicable] [_____] code].

- D. Fabricate column reinforcement with offset bends at reinforcement splices.
- E. Form spiral column reinforcement from minimum **3/8 inch (10 mm)** diameter continuous [plain] [deformed] bar or wire.
- F. Form ties and stirrups from the following:
 - 1. For bars No. **10 (32)** and Smaller: [No. **3 (10)** deformed bars] [[_____]
deformed wire].
 - 2. For bars No. **11 (36)** and Larger: [No. **4 (13)** deformed bars] [[_____]
deformed wire].
- G. Weld reinforcement in accordance with [AWS D1.4] [_____].
- H. [[Galvanized] [Epoxy-Coated]] Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with [CRSI] [_____].
- I. Locate reinforcement splices not indicated on Drawings, at point of minimum stress. [Review location of splices with Architect/Engineer.]

2.4 SHOP FINISHING

Class I galvanized coating provides **3.5 oz/sf (1070 g/sq m)** of zinc, except for **3 (10)** bar size. Class II coating is **2.0 oz/sf (610 g/sq m)** of zinc.

- A. Galvanized Finish for Steel Bars: ASTM A767/A767M, Class [I] [II], hot dip galvanized after fabrication.

For the following two paragraphs, use ASTM A934/A934M for coatings applied after fabrication.

- B. Epoxy Coated Finish for Steel Bars: [ASTM A775/A775M] [ASTM A934/A934M].
- C. Epoxy Coated Finish for Steel Wire: ASTM A884/A884M; Class A using [ASTM A775/A775M] [ASTM A934/A934M].

2.5 SOURCE QUALITY CONTROL

Include this article for complex or critical reinforcement fabrications.

- A. Section 01400 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Make completed reinforcement available for inspection at manufacturer's factory prior to packaging for shipment. Notify Architect/Engineer at least seven days before inspection is allowed.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
 - 1. Do not weld crossing reinforcement bars for assembly [except as permitted by Architect/Engineer].
- B. Do not displace or damage vapor retarder.
- C. Accommodate placement of formed openings.
- D. Space reinforcement bars with minimum clear spacing [in accordance with ACI 318] [of one bar diameter, but not less than 1 inch (25 mm)].
 - 1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.

 Use the following paragraph when concrete cover is not indicated on Drawings. Use second paragraph when concrete cover is required to satisfy fire assembly ratings.

- E. Maintain concrete cover around reinforcement [in accordance with [ACI 318] [[applicable] [_____] code]] [as follows]:

 Edit the following table to suit project conditions. Concrete cover indicated is minimum according to ACI 318 and ICC codes.

Reinforcement Location		Minimum Concrete Cover
Footings and Concrete Formed Against Earth		3 inches (75 mm)
Concrete exposed to earth or weather	No. 6 (19) bars and larger	2 inches (50 mm)
	No. 5 (16) bars and smaller	1-1/2 inches (38 mm)
Supported Slabs, Walls, and Joists	No. 14 (43) bars and larger	1-1/2 inches (38 mm)
	No. 11 (36) bars and smaller	3/4 inches (19 mm)
Beams and Columns		1-1/2 inches (38 mm)
Shell and Folded Plate Members	No. 6 (19) bars and larger	3/4 inches (19 mm)
	No. 5 (16) bars and smaller	1/2 inches (13 mm)

***** [OR] *****

- F. Conform to [applicable] [_____] code for concrete cover over reinforcement.

- G. Provide the following minimum concrete cover over reinforcement when required by [applicable] [_____] code for fire resistive construction.
1. Slabs: [_____] inches ([_____] mm).
 2. Beams, Girders, and Trusses: [_____] inches ([_____] mm).
 3. Joists: [_____] inches ([_____] mm).
 4. Columns: [_____] inches ([_____] mm).
- H. Splice reinforcing [where indicated on Drawings] [_____] in accordance with splicing device manufacturer's instructions.

 Use the following paragraph where bonding and grounding is required.

- I. Bond and ground reinforcement in accordance with requirements of Section [16060] [_____].

3.2 ERECTION TOLERANCES

- A. Section 01400 - Quality Requirements: Tolerances.
- B. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

Reinforcement Depth	Depth Tolerance	Concrete Cover Tolerance
Greater than 8 inches (200 mm)	plus or minus 3/8 inch (10 mm)	minus 3/8 inch (10 mm)
Less than 8 inches (200 mm)	plus or minus 1/2 inch (13 mm)	minus 1/2 inch (13 mm)

3.3 FIELD QUALITY CONTROL

- A. Section [01400 - Quality Requirements: Testing and Inspection Services] [01700 - Execution Requirements: Testing, adjusting, and balancing].

 ICC codes require special inspections and verification, except for some concrete footings, slabs-on-grade, and walls depending on building height, installation conditions, and design methods. Refer to code for specific exemptions.

Except for selected applications, ICC codes require structural tests and special inspections to be performed by testing laboratory employed by Owner or Architect/Engineer.

- B. Field [inspection and] testing will be performed by Owner's testing laboratory in accordance with [ACI 318] [[applicable] [_____] code].

***** [OR] *****

- C. Perform field [inspection and] testing in accordance with [ACI 318] [[applicable] [_____] code].
- D. Provide free access to Work and cooperate with appointed firm.
- E. Reinforcement Inspection:
 - 1. Placement Acceptance: Specified [and ACI 318] material requirements and specified placement tolerances.
 - 2. Welding Inspection Procedures and Acceptance: AWS D1.1.
 - 3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
 - 4. Weldability Inspection: Inspect for reinforcement weldability when formed from steel other than ASTM A706/A706M.
 - 5. Continuous Weld Inspection: Inspect reinforcement as required by [ACI 318] [[applicable] [_____] code].
 - 6. Periodic Weld Inspection: Other welded connections.

3.4 SCHEDULES

Include schedule when differing reinforcement types or finishes are required.

Consider the following examples when developing Project schedule.

- A. Reinforcement For Superstructure Framing Members: Deformed bars, unfinished.
- B. Reinforcement For Foundation Wall Framing Members and Slab-on-Grade: Deformed bars and wire fabric, galvanized finish.
- C. Reinforcement For Parking Structure Framing Members: Deformed bars, epoxy-coated finish.

END OF SECTION